Personal submission by Jeanette Rothapfel, science educator

'The need to switch our students on to Science'

Addressing:-	**the potential benefits that could accrue to Australia through further development of our space capability**

The following is an argument **FOR** the use of national space science initiatives that will inspire students of all educational levels to pursue studies and professions in science and related industries that will maintain the flow of qualified science teachers, scientists, engineers and technologists to ensure our economy's success.

Science has been described as the success story of western civilisation because research and development has dramatically improved the way that we live. Yet, it is of concern to educators, scientists and academics that there is an increasing reluctance by students to choose science subjects for senior studies in secondary school or to pursue science-related professions, especially science teaching. This is strongly supported by state and national statistics. As a science teacher for 40 years and Head Teacher Science in the NSW public school system and President of the Newcastle and Districts Association of Science Teachers for many years, I have witnessed first hand the decrease of interest by students across schools wishing to study science at senior level. As an academic at the University of Newcastle, lecturing to trainee science teachers, I am also exceedingly concerned by the small number of students who will graduate in this important discipline of the teaching profession. Since 2003, I have had only 7-13 students in their final year from an initial enrolment of over 800 students wanting to train as teachers in general.

Science education in Australia may be in crisis with too many students viewing science professions as irrelevant, boring, grossly underpaid and definitely not one of the more glamorous career options. Hackling, Goodrum and Rennie (2001) also commented that post primary students in Australia generally did not sustain any enthusiasm for science beyond their second year after entering junior high school. Thus, the challenge is to change the negative perceptions that students possess about science by capturing their imagination. Australia needs for students to study science in order to maintain the flow of qualified science teachers, scientists, engineers and technologists into industry to build our economy, ensure and maintain its success.

For too many years, HSC science student enrolment in NSW is still remaining at a concerning low proportion of the overall student candidature with Biology continuing to fare a little better than Chemistry and Physics. From 1992 to 2006 the Biology enrolments have fallen from 40% to 24%, Chemistry from 30% to 17.5% and Physics from 27% to 15.5%. Similar concerns of diminishing student enrolments in senior sciences at national level were publicly highlighted by the Australian Council of Deans of Science from a study undertaken by Dobson and Calderon (1999). A major trend highlighted in the study was that if the current rate of secondary school participation in Chemistry and Physics continued, then there will be no enabling science in secondary schools beyond 2020. From this national study, it was revealed that for the three traditional sciences, Biology enrolments decreased by 16.6%, Chemistry enrolments decreased by 12.1% and Physics enrolments decreased by 7.8%.

Switching students on to science can only have outstanding benefits for the economy and scientific literacy of all in this contemporary society. How could we do this? The stimulus of 'space' is definitely a successful conduit for learning and improved motivation in science because the space sciences with associated national initiatives arouse the imagination of all from kindergarten to the adult learner.

The curiosities of the universe are definitely motivational for learning science and Australia has achieved world-wide recognition for its work in this area. I have long realised the value of connecting quality learning with professions and achievements that are significant to Australia. Thus, with the understanding that students have a strong desire to learn about space science, I founded the NSW School of Space Science. Professor Fred Watson, esteemed astronomer, is a supportive patron and contributor to my personal initiative as is Professor John

O'Connor, nationally recognised expert in the field of Physics. This residential experience is designed to inspire students entering Year 10 to select a science for the HSC when required to make subject selections later in the year.

The NSW School of Space Science is strictly a school with lessons from experts including NASA astronaut, Dr Andrew Thomas who opens the school each year with a 1 hour or longer conference call from Houston. NASA scientists like Dr Everett Gibson, a Mars and lunar specialist at the Johnson Space Centre and Dr Carlton Allen, the manager of the moon rocks and meteorites at NASA also present lessons. Naturally, the showcasing of Australian experts is my priority to inform and also excite students about professional potential in Australia. Associate Professor Fred Menk, who played a major role in the development and success of FEDSAT, Wing Commander Pete Wooding, Deputy Director Space of the Royal Australian Air Force, Neal Newman, past NASA representative in Australia, John Sarkissian, project manager of Parkes Radio Telescope, have been some of the highly appreciated presenters of lessons for the school.

The excitement and appreciation that the students express for their experiences at my school are highly satisfying and rewarding to me in my attempt to change the attitudes of students towards science. 100% of students in the past four years have studied a senior science and a very large percentage has gone on to study science at university. The space science workshops I also undertake for K-12 students at state level also strongly reflect the excitement and enjoyment of learning created by inspirational themes of space science.

But, my work represents only a very small percentage of students in Australia. While many quality initiatives occur around the nation, one-off initiatives definitely cannot have a major impact on the wide range of students and their attitudes nor sustain the need for people to undertake science and technology professions. We need to inspire students nationally. Both Australian science and technology will greatly benefit from students wishing to learn about and participate professionally in space science initiatives. If our nation cannot maintain the numbers of its science teachers, scientists and leaders in science, then the nation could stagnate and not move forward quickly enough to keep pace with the scientifically advanced countries.

I, perhaps more than any other Australian educator, can articulate the positive impact that space industries have on encouraging students to become scientists or science teachers. In Australia and the USA, I have personally undertaken formal research to investigate the impact of space science in and beyond the classroom to inspire students. I am also extremely fortunate to work with NASA astronauts, scientists and educators at the Johnson Space Centre in Texas and have conducted research in US schools to assess student attitudes to science with respect to the US space program, space science research and relevant industries. **The effect that the US space program and space science research has on the motivation level of students to immerse themselves in science is outstanding.** While many students do originally imagine themselves as astronauts, they eventually focus on what role they can play in a science that supports their country's space research initiatives and satisfies their personal science goals. 'Space' fires up their imagination and cements their desire to pursue related professions which are ultimately significant for the economy. This, too, occurs in Australia but to a much, much lower extent and only in small pockets of the country where space science is actively promoted. Australia needs to ignite the passion for learning science.

We, as a nation, could promote a broader passion for science by taking advantage of students' natural curiosity for *all things space* supported by the knowledge that Australia is actively undertaking innovative space science initiatives. Let's switch our students on to science before it is too late!

References

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Goodrum, D., Hackling, M., & Rennie, L. (2001). *The status and quality of teaching and learning of science in Australian schools*. Canberra: Department of Education, Training and Youth Affairs.

Academic Credentials

1. Doctor of Education – Hon.DEd (N'ctle, NSW)
2. Master of Science – University of Newcastle
3. Bachelor of Education - University of New England
4. NSW Teacher's Certificate - Newcastle Teachers College

Personal Credibility in Science Education

1. Honoured to be the only private individual in the world (except for two US Presidents) to be granted a **long-term loan of NASA's moon rock samples**, one of the national treasures of the USA. This outstanding privilege reflects NASA's recognition and respect for my educational work in promoting science in Australian education and general public.
2. Australian Space Pioneer Award 2005
3. Australian Space Science Teacher of the Year 2005
4. National BHP Billiton Science Award for Secondary Teachers 2004.
5. Premier's Macquarie Bank Scholarship for Science Teachers 2003
6. Placed on the Australian College of Educators' national honour roll of excellence in education 2003.
7. Inaugural Minister of Education and Training & Australian College of Educators' Quality Teaching Award 2001
8. NSW Minister's Award for Excellence in Teaching, 1998
9. NSW Department of Education Science Education Fellowship 1994
10. NSW Assistant Director-General's Award for 'Outstanding Contributions to Science Education' Hunter Region, 1993,
11. Australian Teacher of the Year 1993
12. Author of space science books for teaching and learning in science:

    Rothapfel, J. (2000). *Journey through the cosmos*. Sydney: Centre for Learning Innovation

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    Rothapfel, J., & O'Toole, M. (2006). *Success in science – Year 9 & 10 science summary.* Seven Hills: Five Senses Education Pty. Ltd.

    Rothapfel, J. (2007). *Andy's solar system adventure*. Seven Hills: Five Senses Education Pty. Ltd.

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